ETOOSINDIA
INDIA'S NO.1 ONLINE COACHING

Environmental Issue

CONTENT

SYLLABUS

Environmental Issue

Air Pollution & its Control, Noise Pollution, Water Pollution & its Control, Solid Wastes and their Disposal, Agrochemical, Radioactive Pollution, Green House Effect and Global Warming, Ozone Depletion, Degradation of Natural Resources, Deforestation, Reforestation and Forest-Conservation

Name : _____   Contact No. _____

Human population has increased enormously in the last century due to which the demand of food, water, home, electricity, roads and automobiles etc. has increased many fold. These demands are creating tremendous pressure on the natural resources and causing environmental pollution (of Air, Water and Soil etc.). On one hand we need to check the degradation and depletion of natural resources, and on the other the level of Pollution is to be controlled without halting the process of development.

Pollution is an undesirable change in physical, chemical or biological characteristics of air, land, water or soil. The agents that bring about such an undesirable change are called **Pollutants.**

For the classification of pollution/pollutants various parameters are used,

- On the basis of the part of environment affected – e.g., *Air pollution, water pollution, soil pollution* etc.

- On the basis of origin of pollutants – e.g., *natural pollutants and Anthropogenic pollutants*

- On the basis of physical nature of pollutants – e.g., *Gaseous pollutants, particulate pollutants (dust, smoke, soot)*

- On the basis of ecosystem – e.g., *Biodegradable pollutants* and *non-biodegradable pollutants*

- On the basis of release process – e.g., *Primary pollutants, secondary pollutants*

- On the basis of forms – e.g., *Radioactive pollutants, plastic pollutants, Toxic pollutants*

To improve the quality of environment (air, water and soil), and control pollution, the Government of India passed **Environment (Protection) Act** in 1986.

AIR POLLUTION AND ITS CONTROL

The air pollutants cause injury to all living organisms. They reduce growth and yield of crop and cause premature death of the plants. In animals or human they adversely affect respiratory system. The harmful effects of pollutants depend upon –

- Duration of exposure

- Concentration of pollutants

- Type of pollutants

- Type of affected organism

The gaseous pollutants include oxides of sulphur (SO_2 and SO_3), oxides of nitrogen (NO and NO_2) and oxides of carbon (CO and CO_2).

The particulate matter includes tiny solid or liquid particles suspended in air.

They may be viable like, pollens, algae, Smelters and *Smoke stacks* (tall chimneys of factories/ industries). Such pollutants must be separated or filtered out before releasing harm less gases into the atmosphere.

To remove harmful gases, like sulphur-di-oxide, from gaseous air pollutants, the **Scrubbers** are used. In scrubber the harmful gases (exhaust) are passed through a spray of water or the lime to separate the clean air.

For removing the *particulate matter* the most commonly used method is **Electrostatic Precipitator**. It can remove up to 99% of particulate matter from the thermal power plant. The electrostatic precipitator has electrode wires produce a **Corona** that release electrons. These electrons get attached to the dust particles by giving them a net - negative charge. The collecting plates are grounded to attract the charged dust – particles. The velocity of air between the plates is kept low enough to allow the dust particles to fall. However, the particulate matter that are very small are not removed by these precipitators.
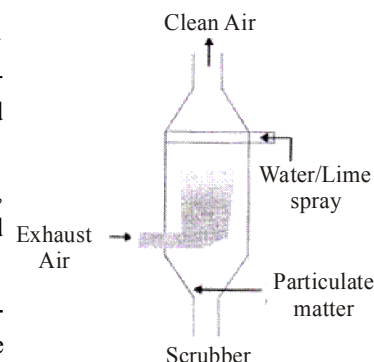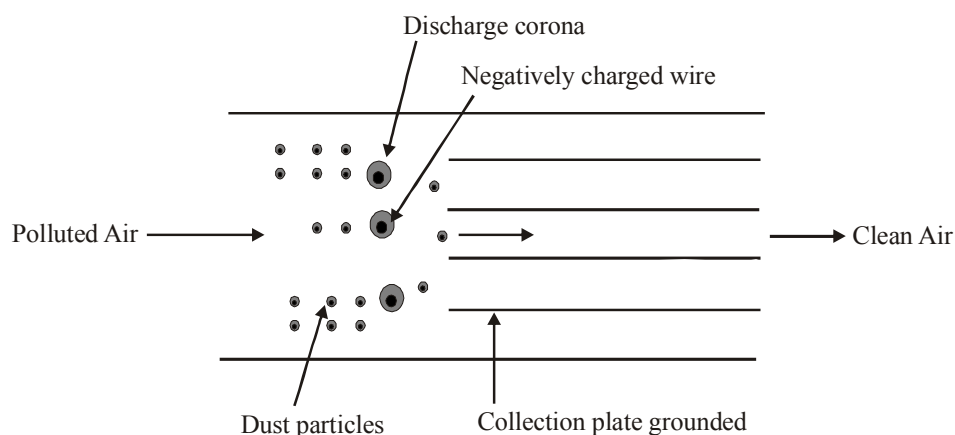
Fig. : Electrostatic Precipitator

According to Central Pollution Control Board (CPCB), the particulate matter of size ≤ 2.5 µm is responsible for causing the greatest harm to the human health since such particulates can be inhaled deep into the lungs and can cause breathing problems, irritation, allergy, inflammation and damage to lungs causing premature death.

Sources of Air pollution

The major cause of air pollution, at least in the metro cities, is the increasing number of automobiles. The emission of vehicular pollutants can be reduced by

- Proper maintenance of automobiles

- Use of lead (Pb) – free fuel (Petrol / Diesel)

- Use of Catalytic Converters

The **Catalytic Converters** have expensive metals like, *Platinum, Palladium* and *Rhodium*, which act as catalyst, when the exhaust fumes pass through the catalytic converter the un-burnt hydrocarbons are converted into CO_2 and H_2O. The CO and Nitric oxide (NO) are converted into CO_2 and N_2 gases. Thus, the emission of poisonous gases is reduced. Since the lead inactivates the catalyst, the motor vehicles equipped with catalytic converters should always us **unleaded** (Lead-free) fuel.

Control of Air Pollution

The city Delhi, in 1990, ranked 4th among the 41 most polluted cities of the world. For the problem of air pollution a Public Interest Litigation **(PIL)** was filed in Supreme court of India. Under its directions the government was asked to take appropriate measures, within the specified time period. This included the switching over of entire fleet of public transport (Buses, Auto-rikshas), from diesel to **CNG (Compressed Natural Gas)**. By the end of 2002, all the buses of Delhi were shifted on CNG.

The CNG is better fuel than Diesel because –

- CNG is cheaper than petrol or diesel.

- CNG burns more efficiently in the automobiles.

- CNG burns more completely and, therefore, very little of it is left un-burnt.

- Unlike petrol or diesel the CNG cannot be adulterated.

- The CNG cannot be siphoned away (stolen) by thieves.

The main problem in switching over to CNG was of laying down of the pipe lines for ensuring uninterrupted supply to the distribution pumps. In Delhi, the other steps taken for reducing vehicular pollution included –

- Phasing out of old vehicles

- Use of unleaded petrol

- Use of low sulphur fuel

- Stringent laws of norms for control of pollution

Auto Fuel Policy

The vehicular emission norms were introduced in India in year 2000 and in the same year **Bharat Stage norms** were adapted.

The **Bharat stage II**, equivalent to **Euro II** norms, was made applicable in 11-cities, i.e., Agra, Ahmadabad, Bengaluru, Chennai, Delhi, Hyderabad, Kanpur, Kolkata, Mumbai, Pune and Surat. It had to be applicable to all automobiles throughout the country from April 1st 2005.

From 1st April 2005, all automobiles had to meet **Euro III** emission specifications in the above 11-cities.

By 1st April 2010, they had to meet **Euro IV** norms.

The rest of the country, by 2010, had to meet **Euro III** emission norms for automobiles and the fuel.

According to the norms of **Euro III** the sulphur was to be controlled at 150 ppm (parts per million) in petrol, and 350 ppm in diesel. The aromatic hydrocarbon were to be regulated at 42% of the fuel. The goal was to reduce sulphur to 50 ppm and hydrocarbon to 35% of the fuel.

According to the corresponding fuel the vehicular engines were also needed to be upgraded.

Bharat Stage - IV (BS -IV) in certain States and Union Territories is to be introduced on **1st April, 2016,** and in the rest of country on **1st April, 2017.**

BS-V emission norms for vehicles across the entire country will be implemented from 2019.

BS-VI for four wheelers will be enforced in India from year **2023.**

NOISE POLLUTION

In India, the **Air (Prevention and control of pollution) Act** came into force in 1981 and in 1987 it was amended to include Noise as an Air pollutant.

Noise is undesirable sound of high level that causes psychological and physiological disorders in human. In larger cities the noise level is much greater. The noise causes annoyance, irritability, headache, sleeplessness, increased palpitations or heart beat and alteration in breathing pattern and the peripheral circulation, to stress human considerably. It affects the overall productive performance. The intensity of sound is the average rate per unit area at which the energy is transferred by the wave onto the surface, i.e.

Intensity of sound = Energy / m^2

The unit of sound intensity is **deciBel (dB),** after the name of Alexander Graham **Bell.** The noise level can range from 0 – 120 dB. Above 120 dB physical discomfort starts. Due to logarithmic scale 10, 20 and 100 deciBel will represent 10 times, 100 times and 1010 times the threshold intensity respectively.

According to **'Central pollution control board'**, the permissible ambient noise levels are

	Day time	Night time
Industrial	75 dB	70 dB
Commercial	65 dB	55 dB
Residential	55 dB	45 dB
Silent zone	50 dB	40 dB

A brief exposure to extremely high level of sound (≥ 150 dB), generated by taking off of a jet-plane or rocket, may damage ear drums and hence can impair hearing ability permanently. The same may also happen from prolonged exposure to even lower noise level.

Control of Noise Pollution

- For reducing industrial sound the Mufflers or the sound absorbent materials can be used.

- The Horn free zones around hospitals and schools can be created.

- Low level of sound can be permitted for crackers and loudspeakers.

- Fixing the time for playing loud speakers, after which they cannot be played.

- Stringent laws should be framed to implement and observe the noise level.

- Planting the tree or dense hedge plants, that act as noise barriers.

- Proper maintenance or lubrication of machines.

WATER POLLUTION AND ITS CONTROL

Human has been abusing all water bodies, like pond, lake, stream, river, estuaries, ocean etc., by disposing all kinds of waste into them. The water bodies are life - line not only for us, but also for other organisms.

For maintaining the cleanliness of water and safeguarding the water bodies, the Government of India passed **Water (Prevention and control of pollution) Act** in 1974.

Types of Water Pollution

- **Physical pollutants –** e.g., Hot water, Oil spill

- **Chemical pollutants –** e.g., Inorganic compounds (Nitrate, phosphates and fluorides etc.), Biocides and heavy metals (Hg, As, Pb, Cd etc.)

- **Biological pollutants –** e.g., Bacteria, protozoans, viruses, helminthes and other pathogens.

All domestic sewage and industrial effluents, without being treated, are dumped into nearby river.

1.   Sewage

Even 0.1% of impurities by sewage, makes the water unfit for human use. These impurities of domestic sewage may include

- Suspended solids – e.g., sand, silt and clay

- Colloidal materials – e.g., Faecal matter, bacteria and fibres of cloth and paper

- Dissolved materials – e.g. Nutrients like Nitrates, phosphates, sodium, calcium and ammonia etc.

The solids from such sewage are easy to remove by physical treatment but the removal of nutrients, toxic metal ions and organic compounds is difficult. (In municipal waste, the detergent residues have excess phosphates, and the organic remains have excess nitrates.)

The Domestic Sewage primarily contains Biodegradable organic matter which is decomposed by bacteria and other micro-organisms. The amount of such organic matter in sewage water is measured by **BOD (Biochemical Oxygen Demand)** method. These organisms rob the dissolved oxygen of water due to which the dissolved oxygen content is sharply declined in down - stream. This depletion of oxygen is responsible for the mortality of planktons, mollusks, fishes and other sensitive organisms (aquatic fauna). However, some tolerant species, like annelid wworm, *Tubifex* and insect larvae (*Chironomous* - larvae) may survive in highly polluted and low DO water. Such species are known as

Effect of sewage discharge on some important characteristics of a river

'**Indicator species'** for polluted water. The '**BOD** is the *measure of oxygen, required by the aerobic decomposers for the biochemical degradation of organic material in water'.* **Higher the BOD, the lower would be the DO'.**

(Please remember - The BOD of clean water is < 5 ppm, and highly polluted water is 17 ppm)
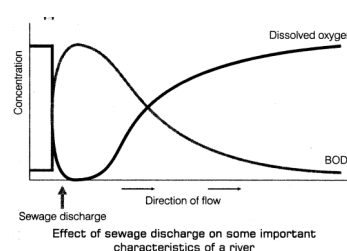
(The 'ppm' means *'parts per million'*. 1 ppm = 1 part in 1,000000)

The presence of a large amount of nutrients in water also causes excessive growth of planktons or free floating algae to produce **Algal bloom.** Such algal blooms

■ Deteriorate the quality of water

■ Cause the mortality of fishes

■ Imparts distinct colour to water bodies

■ May be extremely toxic to human beings and aquatic animals

The excessive growth of a floating plant, **Water Hyacinth** *(Eichhornia crassipes)* has caused havoc in India by blocking our water - ways. In India it is also known as **'Terror of Bengal'.** The *Eichhornia*, considered to be the most problematic weed of the world, was introduced into India, from America, because of its beautiful blue - coloured flowers. It grows abundantly in nutrient rich water bodies and causes an imbalance in the aquatic ecosystem.

The sewage from houses as well as hospitals may contain many undesirable *(pathogenic)* micro-organisms and their disposals into the water bodies, without proper treatment may cause out-break of serious diseases, like, Cholera, Typhoid, Dysentery, Amoebiasis and Jaundice etc.

2. **Industrial Wastes**

Unlike domestic sewage, the waste water from the industries, like chemical industry, paper industry, petroleum industry and metal extraction and process industry, often contains toxic substances like, heavy metals and variety of Organic compounds (e.g., DDT).

Some toxic substances of industrial waste - water may undergo **biological magnification (Biomagnification)** in the aquatic food chain. Since such toxic substances cannot be metabolized or excreted. They get accumulated in the organisms and from there they pass on to the next higher trophic level.

The increase in the concentration of the toxicant at successive trophic levels is called **Biomagnification.** This phenomenon is well known for DDT and Mercury.

The high concentration of DDT in fish – eating birds due to biomagnification of DDT in aquatic food chain has resulted in

■ Disturbance in the Calcium metabolism

■ Thinning of egg – shell, causing premature hatching of chickens

■ Decline in birds – population

Fig. : Biomagnification of DDT in Aquatic food chain

3. **Hot Water**

Another important category of pollutant is heated waste water, released from electricity generating units, like thermal power plants. Such thermal water damages aquatic fauna and flora **(Thermal Pollution).** It also reduces the number of temperature sensitive organisms. Besides, the thermal waste water also reduces the amount of dissolved gases. However, in extremely cold area, such water may enhance the growth of plants and fishes.

There is ageing of water bodies in nature which affect the aquatic ecosystem. Such natural ageing of a water body due to biological enrichment of its water, leading to depletion of species diversity, is called **Eutrophication.**

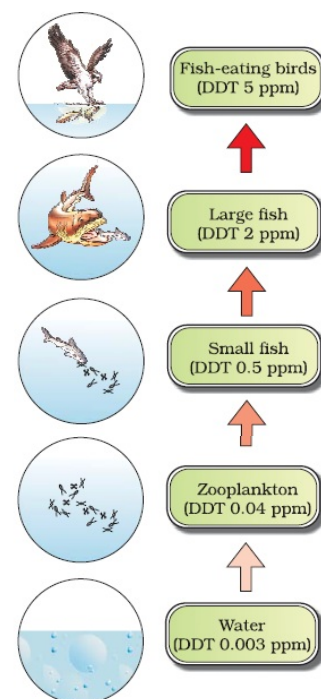■ A young lake has cold and clear water supporting little life.,

■ With the time, the streams draining into lake introduce the nutrients like, Nitrogen and Phosphorus, which encourage the growth of aquatic fauna and flora.

■ When the lake fertility increases, the plants, animals and the micro-organisms multiply very fast and organic remains begin to be deposited at the bottom of the lake.

■ Over the centuries, the organic debris and silt pile up and the lake becomes shallower and warmer. The warm water organisms now replace the cold water organisms.

■ The marsh plants, now begin to fill the original lake. This later gives the way to large masses of floating plants (Bog) which finally converts the lake into land.

The natural ageing of a lake depends upon climate, size of lake and other factors, normally taking thousands of years.

The ageing process can however, be accelerated by the transportation of pollutants from homes, agricultural fields and industries due to human activities. Such wastes may poison the whole population of fish and the decomposing - remains further deplete the dissolved oxygen content, and the lake can literally choke to death. This phenomenon of choking of lake is called **Cultural** or **Accelerated Eutrophication.**

Oil Spills / Pollution

The oil spill is an accidental discharge of petroleum in ocean or estuaries causing *oil pollution* of marine ecosystem.

The oil exploration, oil refineries and offshore oil mining contribute to oil pollution affecting planktons, fish and marine birds. The oil, being lighter than water, spreads as a thin film which is called an **'Oil Slick'.** The oil slick is also harmful to coral reefs.

Integrated Waste - Water Management - A Case Study

The waste water including sewage can be treated in an manner by utilizing a mixture of artificial and natural processes. Such an initiative was taken by the people of the 'Town of Arcata', along the northern coast of California. They collaborated with the biologists of Humboldt State University and created an 'Integrated waste - water treatment system'. This included

1. Conventional method of sedimentation, filtering and chlorine treatment.

2. The development of a series of 6 - connected Marshes (over 60 hectares of marshland)

In such marshes, with the help of biologists, appropriate plants - fungi, algae and bacteria etc. were seeded. Such organisms neutralized, absorbed and assimilated the dangerous pollutants or toxics, like dissolved heavy metals. The water that passed through these marshes got naturally purified.

These marshes also constituted a Sanctuary with a high level of biodiversity from fishes to birds-mammals. A group of people, called **FOAM** (Friends Of the Arcata - Marsh) are responsible for up keeping and safeguarding this project.

Ecological Sanitation (Eco San)

Generally a lot of water is required for the removal of wastes. We use tremendous amount of water to flush the toilet.

The EcoSan is a sustainable system for handling human excreta or faecal; matter by using dry 'Composting Toilets'. Such toilets are very useful for the rural areas where sewer systems are not possible and water supplies are very limited. These toilets are hygienic, efficient, practical and cost effective for the disposal of human waste. With this method the human excreta can be recycled into natural fertilizer (a resource) which lessens the load of chemical fertilizers.

These EcoSan recycle water and organic nutrients of human wastes back into the local environment. Thus such sanitation systems

■ protect the environment and conserve the water

■ Prevent diseases by minimizing the entry of pathogens into water cycle, and thus promote health.

■ Recycle the nutrients and organic matter

Such EcoSan are already working in Kerala and Sri Lanka.

SOLID WASTES AND THEIR DISPOSAL

The solid wastes/ garbage or municipal wastes, is the waste like, paper, textile, plastic, leather, rubber, glass, food waste and metal etc from home, office, school, hospitals and stores etc. Such waste goes into trash. There are various ways to reduce / dispose off or settle this waste and protect the environment from pollution.

Sanitary landfills : These are the depression or trench into which the wastes, after compaction, are dumped and covered with dirt every day. These landfills are the substitutes to 'open dumps'. In metro cities such landfills are also not the solution, since garbage is increased so much that such sites are filled. Moreover, there is danger of seepage of chemicals from the landfills, which may pollute the underground water.

Burning of wastes : Though the burning cannot be done to completion but ut reduces the volume of wastes. The so formed, open dumps, often serve the breeding ground for flies and rats.

Sorting of wastes : Whatever waste or garbage is generated that should be sorted out into separate categories as

(i) Biodegradable wastes (e.g., food. kitchen wastes)

(ii) Recyclable wastes (e.g. paper)

(iii) Non-biodegradable wastes are put into deep- pits in the ground and are left for natural break down.

The recyclable wastes are separated by Rag pickers and kabadiwala. The non-biodegradable wastes, like, plastic, poly-bags, used for packaging or carrying fruits, vegetables, milk, water and grocery etc., are left on the ground and contribute to the environmental pollution. To check the pollution the use of such poly-bags be banned or replaced by eco-friendly cloth bags or carry bags of natural fibres like, jute etc.

Remedy to Plastic - A Case Study

Ahmad Khan, a plastic sac manufacturer in Bangalore, has managed to find a solution to ever increasing problem of accumulating plastic waste. A fine powder of 'recycled modified plastic', called **'polyblend'** was developed by his company. This powder was mixed with bitumen and this mixture of polyblend and bitumen was used to lay roads.

In collaboration with Bangalore City Corporation and R V college of Engineering, Ahmed Khan proved that the blend not only enhanced the water - repellant properties of bitumen but also increased road life by a factor of three. Now against Rs. 0.40 per kg., Khan started offering Rs. 6.00 per kg for the plastic to the rag - pickers. Using Khan's technique about 40 km road in Bangalore had already been laid by 2002, and soon there could be shortage of plastic waste in Bangalore to produce the polyblend. This was a novel way of disposing plastic wastes and reduce the environmental pollution.

Electronic waste (E-waste)

The irreparable computers, TVs, calculators, lap tops, mobiles and other electronic goods are known as e-wastes. Such wastes are either buried in the landfills or incinerated. Over half the be-waste, generated in the developed countries is exported to the developing countries, like India, Pakistan etc. The metals, like Copper, Nickel, Iron, Gold, Silicon etc. are removed by recycling process. Unlike developed countries, in developing countries the recycling involves manual participation which exposes the workers to toxic substances of e-wastes.

Hospital Wastes

The hospitals generate hazardous wastes which contain disinfectants and harmful chemicals. The waste also contains pathogenic micro-organisms. The disposal of such waste requires special attention and care. The use of incinerators is crucial in these cases.

AGROCHEMICALS

The agrochemicals include inorganic fertilizers , insecticides, pesticides, weedicides and fungicides etc. During 'Green revolution', such chemicals were extensively used to increase the production many fold. Their increased and indiscriminate use has shown following effects

- They have proven to be toxic to the non-target organisms, which form the important components of the soil-ecosystem.

- The non-biodegradable agrochemicals have also been *biomagnified* in terrestrial ecosystem.

- The artificial fertilizers, containing phosphates and nitrates, have also caused *eutrophication* in the aquatic ecosystem.

Organic farming - A Case Study

The 'integrated organic farming' is a cyclic and zero waste procedure in which the waste products of one process are cycled to be used as nutrient for the other process. Such farming allows the maximum utilization of the resources and increases efficiency of production.

Mr. Ramesh Chandra Dagar, a farmer in Sonipat (Haryana) has started integrated farming that includes a chain of processes like - Bee keeping, agriculture, Dairy farming, Water harvesting and Composting etc. The processes support each other and make the project extremely economical and well sustainable. Following are the advantages of such farming -

- There is no need of chemical fertilizers for crops.

- The cattle - dung is used as manure.

- The crop waste is used to create compost.

- The so formed compost is used as a Natural fertilizer.

- The compost is also used to generate 'Natural gas' for the energy needs of the farmers.

Mr. Dagar has also created 'Haryana Kisan Welfare Club' to spread the idea of organic farming.

RADIOACTIVE POLLUTION

Initially the use of nuclear energy was considered to be a non-polluting way for generating electricity. Soon it proved to have 2- serious problems -

- Problem of leakage

- Problem of storage and safe disposal

The *accidental leakage* occurred in the **'Three Mile Island'** and **'Chernobyl'.**

The nuclear waste is extremely potent pollutant. The radiation given off by nuclear waste is extremely damaging to biological organisms since it causes mutations at a very high rate. In lower doses, it creates various disorders, the most frequent of which is Cancer. In higher doses the nuclear radiation becomes lethal.

For the storage of nuclear sufficient pretreatment should be done. Moreover, the storage should be done in suitably shielded containers, buried within rocks, about 500 m deep below the earth surface. This method of disposal is being opposed by public.

GREEN HOUSE EFFECT AND GLOBAL WARMING

The green house is a small house using for growing plants especially during winter. In a green house the glass panel lets the light (with long wave - infra red - radiation) in, but does not allow heat (with short wave infra red) to escape. Therefore, the green house warms up very much like inside of a car that has been parked in the sun for a few hrs.

The term **'Green House Effect'** is derived from this phenomenon of green house. It is a naturally occurring phenomenon that is responsible for heating of earth surface and atmosphere. Without a green house effect, the average temperature at earth surface would have been around -18°C, rather than the present average of +15°C.

The sunlight or solar energy when enters into atmosphere about ¼ of it is reflected back due to clouds and gases in the outermost atmosphere, some of it is absorbed, and about half of solar radiation falls on the earth surface for heating it, though a small proportion of it is reflected back form earth.

The earth surface re-emits heat in the form of long wave infra-red radiation, but a major fraction of it is absorbed by atmospheric gases (CO_2, CH_4), and does not escape into space. The molecules of these gases radiate heat energy. A major part of this comes or falls on to earth' surface, thus heating it up once again. This cycle is repeated many a times to warm-up the earth, and continues till the earth-surface does not have longer wave-radiations to emit. The carbon-di-oxide and methane are the main green house gases.

The relative contribution of various green house gases to global warming is

$$CO_2 (60\%) > CH_4 (20\%) > CFC (14\%) > N_2O (06\%)$$
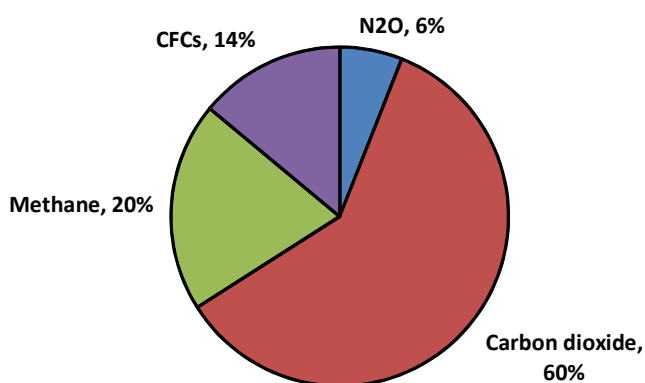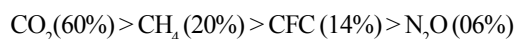
The increase in the level of green house gasses has led to the considerable heating of earth surface leading to **Global Warming.** During last century (1901 – 2000) the temperature of earth has increased by 0.6° C and most of it during last 3-decades (1971 –2000). The deforestation and large scale burning of fossil fuels have contributed to the study rise of CO_2 in the atmosphere which in future would cause increase in average temperature of atmosphere - global warming.

Effects of Global Warming

■ Rise in temperature leading to drastic environmental or climatic changes (e.g., **EI Nino Effect**).

■ Increased melting of polar ice-caps and snow-caps of Himalayas.

■ The rise of sea-level, which may submerge many coastal areas. In next 50-100 years the sea level may rise by 0.5 to 1.5 m.

■ More flood

■ Loss of soil replenishment

■ Increase in the incidence of infectious diseases like, malaria, dengue, yellow fever, sleeping sickness etc.

The increase in CO_2 in the atmosphere will also increase the rate of photosynthesis and plants and adequate rain fall grow faster.

Control of Global Warming

■ Cutting down the use of fossil fuel.

■ Improving efficiency of energy fuel

■ Reducing deforestation

■ Planting the trees

■ Slowing down the growth of human population

■ Reduction in the emission of green - house - gases into the atmosphere.

OZONE DEPLETION

The earth atmosphere is ~ 700 lm. deep and is divisible into 5 - zones (Layers). From ground / earth upwards these zones are :

1. Troposphere   2. Stratosphere   3. Mesosphere   4. Thermosphere

5. Exosphere

Outside Exosphere starts Space. Here, regarding Ozone we will limit ourselves with the first 2-zones only, i.e., Troposphere and Stratosphere.

Good and Bad Ozone

The ozone (O_3) found in upper part of the atmosphere, i.e., Statosphere, is **Good ozone,** since, its acts as a shield for absorbing UV-radiations from sun. The UV rays are highly injurious to living organisms. The DNA and Proteins of living organisms preferentially absorb UV rays. These high energy rays break the chemical bonds of these polymers. The ozone that is formed in lower atmosphere, i.e. Troposphere, is **Bad ozone,** since, it harms plants and animals.

Effects of CPC on Ozone

The ozone in the stratosphere is being continuously formed, from molecular oxygen, and degraded. There occurs a balance between production and degradation of ozone. In last few decades this balance has been disrupted and more ozone has been degraded due to the presence of CFCs(Chlorofluorocarbons). The CFC, used in refrigerators and aerosols, is discharged in troposphere and moves upward to the stratosphere. There the UV rays act on CFC and chlorine (Cl) atoms are released. The Chlorine, acting as a catalyst degrades ozones. Since, the chlorine acts as a catalyst, it is not consumed in the reaction. Thus the addition of CFC into stratosphere has permanent and continuous effect on ozone depletion.

Although, the ozone depletion is occurring widely in the Stratosphere, the depletion is particularly marked over 'Antartic region' ; and this has resulted in the formation of a large area if thinned ozone layer called **'Ozone Hole'.**

The ozone hole over Antarctica develops each year between August to October and the ozone concentration is lowest . During 'Spring', i.e., Feb to April, the ozone concentration is highest.

Unit of Ozone Thickness

The thickness of ozone in a column of air, from the ground to the top of atmosphere, is measured in **Dobson units. (1-Dobson unit = 10 µm thickness of ozone under standard temperature and pressure.)** The term Dobson is after the name of Gordon Dobson of Oxford University. When the ozone thickness becomes less than 220 DU it is considered as thinning of ozone or the ozone hole.

Effects of UV Radiations

The UV radiations of wave length, shorter than UV - B, are completely absorbed by earth atmosphere. But UV-B damages DNA and causes mutations. The UV-B causes ageing of skin and damages the skin cells causing various typed of skin cancers (e.g., Melanoma). In human eye, the cornea absorbs UV-B radiation and high doses of UV-B may cause inflammation of cornea, called 'Snow Blindness', Cataract etc. This may even damage the cornea permanently.

Treaty

Recognizing the harmful effect of ozone-depletion, are international treaty, known a **'Montreal Protocol'** was signed at Monteal (Canada) in 1987, effective in 1989, to control the emission of ozone-depleting substances. The protocol also laid down road-maps, separately for developing and the develop countries, for reducing the emission of CFCs and other such chemicals.

DEGRADATION OF NATURAL RESOURCES

The degradation of natural resources has occurred not only by pollution but also buy Improper utilization of natural resources.

Sole Erosion and Desertification

The development of fertile, top soil, takes centuries but the following human - particles can remove or erode this soil easily

- Over - cultivation

- Urbanization

- Deforestation

- Unrestricted grazing

- Poor irrigation

When large barren patches extend and meet over time, a desert is created. Now-a-days the desertification is occurring mainly because of urbanization, by human activities.

Water-Logging and Soil Salinity

The problems have come-up-due to Green revolution. When irrigation is done and there is no proper drainage of water, it leads to water-logging in the soil.

Besides, affecting the crops, the water logging draws down salt to soil surface. This soil is deposited as a thin crust and also accumulates in the roots of plants. This increased salt content (Soil-salinity) is injurious to the growth of crops and damages agriculture.

DEFORESTATION, REFORESTATION AND FOREST-CONSERVATION

Deforestation is the conversion of the forested area into non-forested area.

Presently about 40% forests in tropical and 1% in temperate region have been lost. In India, at the beginning of 20th century the forest area/ cover was - 30% and by the end of the century it has shrunken to only 19.4%.

National Forest Policy, in 1988, recommended 33% forest cover for plains and 67% for hilly area.

Factors for Deforestation

- Conversion of forest area into agriculture land to feed growing human population.

- Cutting of trees for fire-wood, timber, cattle - farming (Ranching) etc.

Jhum Cultivation (Slash and Burn Agriculture)

In North–East states of India Jhum cultivation has been responsible for deforestation. The farmers cut-down the trees of forest and burn the plant - remains. The 'land' so developed is use for farming or cattle grazing, and 'ash' is used as fertilizer. After cultivation, the area is left for several years so as to allow its recovery. The farmers then move on to other forest areas and repeat the process.

During earlier days of Jhum cultivation enough time-gap was given for land - recovery from the effect of cultivation. later. With increasing population, and repeated cultivation, the recovery phase was done away, and this resulted with deforestation.

Consequence of Deforestation

- Since the trees that hold a lot of carbon-di-oxide in their biomass, are cut down, there is increase in CO_2 concentration in atmosphere, causing global warming.

- Lossw of biodiversity due to habitat-destruction.

- Soil erosion that later leads to desertification.

- Disturbance of hydrological cycle

Reforestation

It is the process of restoring a forest. Though the reforestation may occur naturally in a deforested area, but it is speeded up by planting the forest trees.

(Please remember that the management of forests for the both benefit of the entire ecosystem is called **Silviculture.** The **Forestry**, on the other hand, is the practice of growing and managing forests trees for the production of commercial timber).

Forest Conservation

In people-participation, for the conservation of forests, the role of Bishnois and Garhwalis has been exemplary.

Amrita Devi (Bishnoi) and her 3 - daughters sacrificed their life for the cause of environment. For them the Trees mattered more than their own life.

Similarly, the local women of Garhwal Himalaya, protected the trees by hugging them. This is popularity known as **Chipko Movement** (1974).

Government of India has recently announced **'Amrita Devi Bishnoi Wild Life Protection Award'** for the individuals or communities from the rural area who have courage and dedication in the protection of wildlife.

Looking to the participation of local people, the Government of India in 1980, also introduced the concept of **Joint Forest Management' (JFM)** for the protection and management of the forests. From such projects the rural communities get the benefits of the forest products, like Rubber, Gum, Resin and Medicinal products etc. and thus, conserve the forests in a sustainable manner.